CLAIMS:

1. 1n optical inspection system, comprising:

an illumination source that generates electromagnetic radiation that illuminates a first side and a second side of a substrate inserted into an optical inspection system; and

a detector that detects a light scattering feature on the first side of the substrate from the illumination scattered from the light scattering feature on the first side of the substrate and that detects a light scattering feature on the second side of the substrate from the illumination scattered from the light scattering feature on the second side of the substrate wherein light scattering features on both sides of the substrate are simultaneously detected.

2. The system of Claim 1, wherein the light scattering features further comprise one of a defect in the substrate, a scratch on a surface of the substrate, a pit on a surface of the substrate, a particle on a surface of the substrate, device patterns and pattern anomalies on a surface of the substrate, etched regions on a surface of the substrate, polish roughness on a surface of the substrate, texture on a surface of the substrate, embedded particles in films on a surface of the substrate and any aspect of a surface of the substrate that scatters light.

3. The system of Claim 1, wherein the illumination source, substrate handler and the detector are incorporated into a stand-alone optical inspection system.

4. The system of Claim 1, wherein the illumination source, substrate handler and the detector are incorporated into a benchtop optical inspection system.

5. The system of Claim 1, wherein the optical inspection system is incorporated into a process tool system.

6. The system of Claim 1, wherein the optical inspection system is incorporated into an equipment front end module system.

7. The system of Claim 1, wherein the illumination source further comprises a polarizer to generate uniformly polarized electromagnetic radiation that is directed towards the substrate.

8. The system of Claim 1, wherein the illumination source further comprises a shadow casting assembly that limits the electromagnetic radiation to the edges of the substrate.

9. The system of Claim 1, wherein the illumination source further comprises an image relay assembly that limits the electromagnetic radiation to the edges of the substrate.

10. The system of Claim 9, wherein the image relay assembly further comprises an aperture that limits the electromagnetic radiation generated by the illumination source to the edges of the substrate.

11. The system of Claim 1, wherein the illumination source further comprises a first illumination source unit and a second illumination source unit, wherein the first illumination source unit provides electromagnetic radiation to the first side of the substrate and the second illumination source unit provides electromagnetic radiation to the second side of the substrate.

12. The system of Claim 11, wherein the detector further comprises a first detector unit and a second detector unit wherein the first detector unit detects light scattering features on the first side of the substrate and the second detector unit detects light scattering features on the second side of the substrate.

13. The system of Claim 1, wherein the detector further comprises a first detector unit and a second detector unit wherein the first detector unit detects light scattering features on the first side of the substrate and the second detector unit detects light scattering features on the second side of the substrate.

14. The system of Claim 1, wherein the detector further comprises a movable detector unit that is movable between two or more positions so that the angle of the movable detector unit with respect to the substrate and the angle that the scattered illumination enters the movable detector unit is adjustable.

15. The system of Claim 14, wherein the illumination source further comprises a movable illumination source unit that is movable between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

16. The system of Claim 1, wherein the illumination source further comprises a movable illumination source unit that is movable between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

17. The system of Claim 1, wherein the illumination source generates bright field illumination and dark field illumination.

18. The system of Claim 1 further comprising a substrate handler that holds a substrate inserted into the optical inspection system so that light scattering features on the first and second sides of the substrate are detected simultaneously.

19. The system of Claim 1, wherein the substrate further comprises a semiconductor wafer.

20. The system of Claim 19, wherein the wafer is unpatterned.

21. The system of Claim 19, wherein the wafer is patterned.

22. The system of Claim 1, wherein the substrate further comprises a disk drive substrate.

23. The system of Claim 1, wherein the illumination source further comprises a ring illumination source adjacent the periphery of the substrate that directs light towards the edges of the substrate so that a light scattering feature on one of an edge and a bevel of the substrate is detected.

24. The system of Claim 1, wherein the illumination source further comprises a plurality of illumination source units that each illuminate a different parallel strip of the substrate to provide illumination uniformity.

25. The system of Claim 1, wherein the illumination source further comprises a plurality of illumination source units located around the periphery of the substrate.

26. The system of Claim 1, wherein the illumination source further comprises a set of light path optics that directs the illumination energy from the illumination source to the substrate.

27. The system of Claim 1, wherein the illumination source further comprises an electromagnetic radiation source that generates at least deep ultraviolet electromagnetic energy.

28. The system of Claim 1, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting small light scattering features close to large scattering features, differential measurements where small scattering features have been added to high scatter regions and process signatures.

29. The system of Claim 1, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting brightfield substrate features.

30. The system of Claim 1, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting bar code and alphanumeric substrate identification substrate features.

31. The system of Claim 1, wherein the detector further comprises an anti-blooming detector.

32. The system of Claim 31, wherein the detector provides random access read-out of each pixel associated with the detector and the read-out of each pixel of the detector is non-destructive.

33. The system of Claim 1, wherein the detector further comprises a detector head that comprises a detector chip and a microprocessor that controls the operation of the detector chip.

34. The system of Claim 1, wherein the detector further comprises a back thinned detector chip so that electromagnetic radiation is detected through a backside of the detector chip.

35. The system of Claim 1, wherein the detector further comprises one or more detector chips each having an array of detector pixels wherein each detector chip is butted against another detector chip to form an larger array of detector pixels.

36. The system of Claim 1, wherein an angle of incidence of scattering feature illumination light on the detector is between 50 degrees and 75 degrees.

37. The system of Claim 1, wherein the scattering feature light impinging on the detector is collimated to less than or equal to +/- 2 degrees from the nominal angle of incidence.

38. The system of Claim 1, wherein the scattering feature light impinging on the substrate is spatially uniform in intensity across the substrate with uniformity equal to or greater than 50%.

39. The system of Claim 1, wherein the scattering feature light impinging on the substrate is spectrally uniform across the beam collimated equal to or greater than 95%

40. The system of Claim 1, wherein the detector further comprises collection optics that images the scattered illumination from the light scattering features of the substrate onto the detector.

41. The system of Claim 1, wherein the detector further comprises collection optics having a device that scans through a plurality of wavelengths during the inspection of the substrate.

42. The system of Claim 1, wherein the illumination source further comprises a device that scans through a plurality of wavelengths during the inspection of the substrate.

43. The system of Claim 42, wherein the wavelength scanning device further comprises a wavelength selectable filter that adjust the wavelength of the electromagnetic radiation during the inspection of a substrate to classify the light scattering feature on the surface of the substrate.

44. The system of Claim 1, wherein the illumination source delivers at least 0.25 watts per square inch to the substrate.

45. The system of Claim 44, wherein the illumination source delivers more than 0.25 watts per square inch to the substrate.

46. The system of Claim 1, wherein the illumination source further comprises an arc lamp source that produces deep ultraviolet electromagnetic radiation.

47. The system of Claim 1, wherein the illumination source further comprises one of a laser source, a light emitting diode source, a combination of sources such as deuterium and tungsten, and arc lamps with mercury or other gas mixtures all that produce deep ultraviolet electromagnetic radiation.

48. The system of Claim 1, wherein the illumination source further comprises a focused arc source which reduces the optics needed to focus the electromagnetic radiation onto the substrate.

49. The system of Claim 1, wherein the illumination source further comprises a broadband electromagnetic radiation source that generates electromagnetic radiation at a plurality of wavelengths.

50. The system of Claim 49, wherein the plurality of wavelengths further comprises 200 nm to 1100 nm.

51. The system of Claim 1, wherein the illumination source is modulated which improves the signal to noise ratio of the system.

52. The system of Claim 1, wherein the detector further comprises a collection light path from the substrate to the detector, the light path further comprising refractive elements wherein the scattered illumination from the light scattering features on the substrate is imaged onto the detector.

53. The system of Claim 1, wherein the detector further comprises a collection light path from the substrate to the detector, the light path further comprising a refractive lens and a reflective Schwarzchild lens.

54. The system of Claim 1, wherein the detector further comprises a plurality of pixels and a microlens associated with each pixel of the detector wherein the each microlens focuses the scattering feature illumination onto the pixel associated with the microlens.

55. The system of Claim 1, wherein the detector further comprises a sensor device having a plurality of pixels, each pixel of the digital sensor having an integrated pixel pre-amplifier.

56. The system of Claim 55, wherein the sensor further comprises a charge injection device.

57. The system of Claim 1, wherein the detector further comprises a CMOS sensor.

58. The system of Claim 1, wherein the detector further comprises a CCD sensor.

59. The system of Claim 1, wherein the detector further comprises a photodiode array sensor.

60. The system of Claim 1, wherein the detector further comprises a plurality of sensor elements wherein the sensor elements are adjacent each other to form the detector.

61. The system of Claim 1, wherein the detector further comprises a computer that processes digital data corresponding to the scattered illumination from the light scattering feature on the substrate.

62. The system of Claim 61, wherein the detector further comprises a dithering process.

63. The system of Claim 61, wherein the detector further comprises a random integration process.

64. The system of Claim 18, wherein the substrate handler further comprises a substrate holder further comprising one or more edge gripper mechanisms that support the substrate at its edges so that both sides of the substrate are optically inspected.

65. The system of Claim 64, wherein the substrate handler further comprises one or more wheels that rotate the substrate holder to position the substrate.

66. The system of Claim 64, wherein the substrate handler further comprises one or more ring bearings that permit rotation of the substrate holder to position the substrate.

67. The system of Claim 64, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

68. The system of Claim 67, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

69. The system of Claim 68, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

70. The system of Claim 64, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

71. The system of Claim 70, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

72. The system of Claim 71, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

73. The system of Claim 18, wherein the substrate handler further comprises an edge gripper mechanism and a lifting mechanism wherein the lifting mechanism moves the substrate into a position and retracts away from the substrate.

74. The system of Claim 73, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

75. The system of Claim 74, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

76. The system of Claim 75, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

77. The system of Claim 73, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to support the substrate and grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

78. The system of Claim 77, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

79. The system of Claim 78, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

80. The system of Claim 1 further comprising a computer system that controls the operation of the illumination source and the detector, wherein the computer system further comprises a differential measurement process wherein an initial light scattering feature measurement is subtracted from a subsequent light scattering feature measurement.

81. The system of Claim 1 further comprising a sealed enclosure to reduce contaminants within the optical inspection system.

82. The system of Claim 81, wherein the sealed enclosure is one or more of vacuum tight, gas tight and light tight.

83. The system of Claim 1, wherein the illumination source further comprises an edge illumination source that directs electromagnetic radiation towards an edge and bevel of the substrate so

that the detector receives the illumination scattered from a light scattering feature on the bevel and edge of the substrate and detects light scattering features on the bevel and edge of the substrate.

84. The system of Claim 41, wherein the wavelength scanning device further comprises a wavelength band pass filter that selectively permits scattering feature illumination for a particular wavelength to impinge of the detector.

85. The system of Claim 1, wherein the illumination source further comprises a shutter that blocks the electromagnetic radiation before the electromagnetic radiation illuminates the substrate.

86. The system of Claim 1, wherein the illumination source further comprises an intensity sensor that measures the intensity of the electromagnetic radiation emitted by the illumination source.

87. The system of Claim 1, wherein the detector further comprises a polarizer that filters the scattering feature light according to the polarization of the scattering feature scattered light.

88. The system of Claim 87, wherein the illumination source further comprises a polarizer that is aligned so that the illumination is cross polarized with respect to the polarizer at the detector.

89. The system of Clam 1, wherein the illumination source further comprises a homogenizer.

90. The system of Claim 1, wherein the illumination source further comprises a device that filters infrared electromagnetic radiation out of the illumination directed towards the substrate.

91. The system of Claim 1, wherein the illumination source generates infrared electromagnetic radiation that is directed towards the substrate to measure characteristics of the substrate including one of film thickness, substrate structure, thickness and uniformity.

92. The system of Claim 1 further comprising a computer system that controls the illumination source and the detector, the computer system further comprising a module for determining a process problem signature based on the light scattering features detected on the substrate.

93. The system of Claim 18, wherein the substrate handler orients a notch of the substrate at approximately 45 degrees with respect to the electromagnetic radiation from the illumination source.

94. The system of Claim 1, wherein the illumination source further comprises a dual ring illumination source that illuminates an edge and a bevel of the substrate to detect light scattering features on the edge and bevel of the substrate.

95. The system of Claim 1 further comprising a flip mirror that directs the electromagnetic radiation from the illumination source to both surfaces of the substrate at different time periods.

96. The system of Claim 95 further comprising a second flip mirror that directs the illumination from the light scattering features on the first side to the detector at a predetermined time and that directs the illumination from the light scattering features on the second side to the detector at a second predetermined time.

97. The system of Claim 1 further comprising a beam dump that absorbs the illumination that is not scattered by the light scattering features on the first and second sides of the substrate, the beam dump further comprising one or more light absorbing plates wherein the light is reflected between the one or more light absorbing plates.

98. The system of Claim 97, wherein the one or more light absorbing plates further comprises a first light absorbing plate positioned so that the light strikes the first light absorbing plate at an angle of 30 to 60 degrees.

99. The system of Claim 22, wherein the disk drive substrate further comprises a disk region that surrounds a central hole and wherein the illumination source generates a washer shaped illumination pattern that illuminates the disk region but not the central hole.

100. The system of Claim 99, wherein the illumination source further comprises a first illumination source that generates an illumination pattern that illuminates a first portion of the disk region wherein the disk region is entirely illuminated when the disk drive substrate is rotated.

101. The system of Claim 99, wherein the illumination source further comprises a second illumination source that generates an illumination pattern that illuminates a second portion of the disk region different from the first portion, wherein the first and second illumination sources are rotated 90 degrees with respect to each other and the first and second portions of the disk region comprise the entire disk region and the illumination is parallel to the texture thereby enhancing particle and pit defects while suppressing texture scatter.

102. The system of Claim 99, wherein the illumination source generates electromagnetic radiation that is perpendicular to a texture of the disk drive substrate to measure the texture of the disk drive substrate.

103. An optical inspection method, comprising:

generating illumination that illuminates a first side and a second side of a substrate inserted into the optical inspection system; and

receiving, at a detector, illumination scattered from a light scattering feature on the first side of the substrate and illumination scattered from a light scattering feature on the second side of the substrate; and

detecting the light scattering features on the first side of the substrate corresponding to the illumination scattered from the light scattering feature on the first side of the substrate and detecting light scattering features on the second side of the substrate corresponding to the illumination scattered from the light scattering feature on the second side of the substrate wherein light scattering features on both sides of the substrate are simultaneously detected.

104. The method of Claim 103, wherein the light scattering features further comprise one of a defect in the substrate, a scratch on a surface of the substrate, a pit on a surface of the substrate, a particle on a surface of the substrate, device patterns and pattern anomalies on a surface of the substrate, etched regions on a surface of the substrate, polish roughness on a surface of the substrate, texture on a surface of the substrate, embedded particles in films on a surface of the substrate and any aspect of a surface of the substrate that scatters light.

105. The method of Claim 103, wherein generating the illumination further comprises generating uniformly polarized electromagnetic radiation that is directed towards the substrate.

106. The method of Claim 103, wherein generating the illumination further comprises using a shadow casting assembly that limits the electromagnetic radiation to the edges of the substrate.

107. The method of Claim 103, wherein generating the illumination further comprises using an image relay assembly that limits the electromagnetic radiation to the edges of the substrate.

109. The method of Claim 103, wherein generating the illumination further comprises providing electromagnetic radiation to the first side of the substrate using a first illumination source unit and providing electromagnetic radiation to the second side of the substrate using a second illumination source unit.

110. The method of Claim 109, wherein detection further comprises detecting light scattering features on the first side of the substrate using a first detector unit and detecting light scattering features on the second side of the substrate using a second detector unit.

111. The method of Claim 103, wherein detection further comprises detecting light scattering features on the first side of the substrate using a first detector unit and detecting light scattering features on the second side of the substrate using a second detector unit.

112. The method of Claim 103, wherein detection further comprises moving a detector unit between two or more positions so that the angle of the movable detector unit with respect to the substrate and the angle that the scattered illumination enters the movable detector unit is adjustable.

113. The method of Claim 112, wherein illumination further moving an illumination source unit between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

114. The method of Claim 103, wherein illumination further comprises moving the illumination source unit between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

115. The method of Claim 103, wherein the illumination further comprises generating bright field illumination and dark field illumination.

116. The method of Claim 103 further comprising holding a substrate with a substrate handler so that light scattering features on the first and second sides of the substrate are detected simultaneously.

117. The method of Claim 103, wherein the substrate further comprises a semiconductor wafer.

118. The method of Claim 117, wherein the wafer is unpatterned.

119. The method of Claim 117, wherein the wafer is patterned.

120. The method of Claim 103, wherein the substrate further comprises a disk drive substrate.

121. The method of Claim 103, wherein the illumination further comprises using a ring illumination source adjacent the periphery of the substrate that directs light towards the edges of the substrate so that a light scattering feature on one of an edge and a bevel of the substrate is detected.

122. The method of Claim 103, wherein the illumination further comprises illuminating a different parallel strip of the substrate using a plurality of illumination source units to provide illumination uniformity.

123. The method of Claim 103, wherein the illumination further comprises using a plurality of illumination source units located around the periphery of the substrate.

124. The method of Claim 103, wherein the illumination further comprises directing the illumination energy from the illumination source to the substrate using a set of light path optics.

125. The method of Claim 103, wherein the illumination further comprises generating at least deep ultraviolet electromagnetic energy.

126. The method of Claim 103, wherein the detection further comprises detecting light scattering features close to large scattering features, differential measurements where small scattering features have been added to high scatter regions and process signatures using a high dynamic range, high precision detector array.

127. The method of Claim 103, wherein the detection further comprises detecting brightfield substrate features using a high dynamic range, high precision detector array.

128. The method of Claim 103, wherein the detection further comprises detecting bar code and alphanumeric substrate identification substrate features using a high dynamic range, high precision detector array.

129. The method of Claim 103, wherein the detection further comprises using an anti-blooming detector.

130. The method of Claim 129, wherein the detection further comprises providing random access read-out of each pixel associated with the detector and the read-out of each pixel of the detector is non-destructive.

131. The method of Claim 103, wherein the detection further comprises using a detector head that comprises a detector chip and a microprocessor that controls the operation of the detector chip.

132. The method of Claim 103, wherein the detection further comprises detecting electromagnetic radiation through a backside of a detector chip using a back thinned detector chip.

133. The method of Claim 103, wherein the detection further comprises butting one or more detector chips each having an array of detector pixels against each other to form an larger array of detector pixels.

134. The method of Claim 103, wherein an angle of incidence of scattering feature illumination light on the detector is between 50 degrees and 75 degrees.

135. The method of Claim 103, wherein the scattering feature light impinging on the detector is collimated to less than or equal to +/- 2 degrees from the nominal angle of incidence.

136. The method of Claim 103, wherein the scattering feature light impinging on the substrate is spatially uniform in intensity across the substrate with uniformity equal to or greater than 50%.

137. The method of Claim 103, wherein the scattering feature light impinging on the substrate is spectrally uniform across the beam collimated equal to or greater than 95%

138. The method of Claim 103, wherein the detection further comprises imaging the scattered illumination from the light scattering features of the substrate onto the detector.

139. The method of Claim 103, wherein the detection further comprises scanning through a plurality of wavelengths during the inspection of the substrate.

140. The method of Claim 103, wherein the illumination further comprises scanning through a plurality of wavelengths during the inspection of the substrate.

141. The method of Claim 140, wherein the wavelength scanning further comprises using a wavelength selectable filter that adjust the wavelength of the electromagnetic radiation during the inspection of a substrate to classify the light scattering feature on the surface of the substrate.

142. The method of Claim 103, wherein the illumination further comprising delivering at least 0.25 watts per square inch to the substrate.

143. The method of Claim 142, wherein the illumination further comprising delivering more than 0.25 watts per square inch to the substrate.

144. The method of Claim 103, wherein the illumination further comprises using an arc lamp source that produces deep ultraviolet electromagnetic radiation.

145. The method of Claim 103, wherein the illumination further comprises using one of a laser source, a light emitting diode source, a combination of sources such as deuterium and tungsten, and arc lamps with mercury or other gas mixtures.

146. The method of Claim 103, wherein the illumination further comprises using a focused arc source which reduces the optics needed to focus the electromagnetic radiation onto the substrate.

147. The method of Claim 103, wherein the illumination further comprises using a broadband electromagnetic radiation source that generates electromagnetic radiation at a plurality of wavelengths.

148. The method of Claim 147, wherein the plurality of wavelengths further comprises 200 nm to 1100 nm.

149. The method of Claim 103, wherein the illumination further comprising modulating the illumination to improve the signal to noise ratio.

150. The method of Claim 103, wherein the detection further comprises using refractive elements to collect the scattered illumination wherein the scattered illumination from the light scattering features on the substrate is imaged onto the detector.

151. The method of Claim 103, wherein the detection further comprises using a collection light path from the substrate to the detector, the light path further comprising a refractive lens and a reflective Schwarzchild lens.

152. The method of Claim 103, wherein the detection further comprises using a plurality of pixels and a microlens associated with each pixel of the detector wherein the each microlens focuses the scattering feature illumination onto the pixel associated with the microlens.

153. The method of Claim 103, wherein the detection further comprises using a digital sensor device having a plurality of pixels, each pixel of the digital sensor having an integrated pixel pre-amplifier.

154. The method of Claim 153, wherein using the digital sensor further comprises using a charge injection device.

155. The method of Claim 103, wherein the detection further comprises using a CMOS sensor.

156. The method of Claim 103, wherein the detection further comprises using a CCD sensor.

157. The method of Claim 103, wherein the detection further comprises using a photodiode array sensor.

158. The method of Claim 103, wherein the detection further comprises using a plurality of sensor elements wherein the sensor elements are adjacent each other to form the detector.

159. The method of Claim 103, wherein the detection further comprises using a computer that processes digital data corresponding to the scattered illumination from the light scattering feature on the substrate.

160. The method of Claim 159, wherein the detection further comprises a dithering process.

161. The method of Claim 159, wherein the detection further comprises a random integration process.

162. The method of Claim 116, wherein the substrate handling further comprises using a substrate holder further comprising one or more edge gripper mechanisms that support the substrate at its edges so that both sides of the substrate are optically inspected.

163. The method of Claim 162, wherein the substrate handling further comprises using one or more wheels that rotate the substrate holder to position the substrate.

164. The method of Claim 162, wherein the substrate handling further comprises using one or more ring bearings that permit rotation of the substrate holder to position the substrate.

165. The method of Claim 162, wherein using the edge gripper mechanism further comprise using an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

166. The method of Claim 165, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

167. The method of Claim 166, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

168. The method of Claim 162, wherein using the edge gripper mechanism further comprises using a support structure and an edge gripper structure integrated into the support structure to grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

169. The method of Claim 168, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

170. The method of Claim 169, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

171. The method of Claim 116, wherein the substrate handling further comprises using an edge gripper mechanism and a lifting mechanism wherein the lifting mechanism moves the substrate into a position and retracts away from the substrate.

172. The method of Claim 171, wherein using the edge gripper mechanism further comprise using an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

173. The method of Claim 172, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

174. The method of Claim 173, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

175. The method of Claim 171, wherein using the edge gripper mechanism further comprises using a support structure and an edge gripper structure integrated into the support structure to support the substrate and grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

176. The method of Claim 175, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

177. The method of Claim 176, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

178. The method of Claim 103 further comprising controlling the operation of the illumination source and the detector using a computer system, wherein the computer system further comprises a differential measurement process wherein an initial light scattering feature measurement is subtracted from a subsequent light scattering feature measurement.

179. The method of Claim 103 further comprising using a sealed enclosure to reduce contaminants within the optical inspection method.

180. The method of Claim 179, wherein the sealed enclosure is one or more of vacuum tight, gas tight and light tight.

181. The method of Claim 103, wherein the illumination further comprises using an edge illumination source that directs electromagnetic radiation towards a bevel of the substrate so that the detector receives the illumination scattered from a light scattering feature on the bevel of the substrate and detects light scattering features on the bevel of the substrate.

182. The method of Claim 134, wherein the wavelength scanning further comprises using a wavelength band pass filter that selectively permits scattering feature illumination for a particular wavelength to impinge of the detector.

183. The method of Claim 103, wherein the illumination further comprises using a shutter that blocks the electromagnetic radiation before the electromagnetic radiation illuminates the substrate.

184. The method of Claim 103, wherein the illumination further comprises measuring the intensity of the electromagnetic radiation emitted by the illumination source using an intensity sensor.

185. The method of Claim 103, wherein the detection further comprises filtering the scattering feature light according to the polarization of the scattering feature scattered light.

186. The method of Claim 185, wherein the illumination further comprises using a polarizer that is aligned so that the scattering feature scattered light is cross polarized with respect to the polarizer at the detector.

187. The method of Clam 103, wherein the illumination further comprises using a homogenizer.

188. The method of Claim 103, wherein the illumination further comprises filtering infrared electromagnetic radiation out of the illumination directed towards the substrate.

189. The method of Claim 103, wherein the illumination further comprising generating infrared electromagnetic radiation that is directed towards the substrate to measure characteristics of the substrate including one of film thickness, substrate structure, thickness and uniformity.

190. The method of Claim 103 further comprising controlling the illumination source and the detector using a computer system, the computer system further comprising a module for determining a process problem signature based on the light scattering features detected on the substrate.

191. The method of Claim 116, wherein the substrate handling further comprising orienting a notch of the substrate at approximately 45 degrees with respect to the electromagnetic radiation from the illumination source.

192. The method of Claim 103, wherein the illumination further comprises using a dual ring illumination source that illuminates an edge and a bevel of the substrate to detect light scattering features on the edge and bevel of the substrate.

193. The method of Claim 103 further comprising a directs the electromagnetic radiation from the illumination source to both surfaces of the substrate at different time periods.

194. The method of Claim 193 further comprising directing the illumination from the light scattering features on the first side to the detector at a predetermined time and directing the illumination from the light scattering features on the second side to the detector at a second predetermined time.

195. The method of Claim 103 further comprising absorbing the illumination that is not scattered by the light scattering features on the first and second sides of the substrate, the absorbing further comprising reflecting the illumination between the one or more light absorbing plates.

196. The method of Claim 195, wherein the absorbing further comprising positioning a first light absorbing plate so that the light strikes the first light absorbing plate at an angle of 30 to 60 degrees.

197. The method of Claim 120, wherein the disk drive substrate further comprises a disk region that surrounds a central hole and wherein the illumination source generates a washer shaped illumination pattern that illuminates the disk region but not the central hole.

198. The method of Claim 197, wherein the illumination further comprises generating an illumination pattern using a first illumination unit that illuminates a first portion of the disk region wherein the disk region is entirely illuminated when the disk drive substrate is rotated.

199. The method of Claim 197, wherein the illumination further comprises generating an illumination pattern that illuminates a second portion of the disk region different from the first portion using a second illumination source, wherein the first and second illumination sources are rotated 90 degrees with respect to each other and the first and second portions of the disk region comprise the entire disk region.

200. The method of Claim 197, wherein the illumination further comprises generating electromagnetic radiation that is perpendicular to a texture of the disk drive substrate to measure the texture of the disk drive substrate.

201. A light collection system, comprising:

a detector; and

light collection optics that direct collimated electromagnetic radiation towards the detector, the light collection optics providing deep ultraviolet electromagnetic transmission, small blur and low distorting images to the detector.

202. The system of Claim 201, wherein the light collection optics has a device that scan through a plurality of wavelengths during the inspection of the substrate.

203. The illumination source of Claim 202, wherein the wavelength scanning device further comprises a wavelength selectable filter that adjust the wavelength of the electromagnetic radiation

during the inspection of a substrate to classify the light scattering feature on the surface of the substrate.

204. The system of Claim 201, wherein the light collection optics further comprise a refractive lens and a reflective Schwarzchild lens.

205. The system of Claim 201, wherein the light collection optics further comprise a microlens associated with each pixel of the detector, each microlens focusing the electromagnetic radiation onto a particular pixel of the detector.

206. A digital image detector, comprising:

a plurality of pixels arranged in an array wherein each pixel detects electromagnetic radiation that impinges on that pixel; and

each pixel having a pre-amplifier that amplifies the signal from that pixel.

207. The detector of Claim 206 further comprising a microlens associated with each pixel of the detector, each microlens focusing electromagnetic radiation onto the pixel associated with the microlens.

208. The detector of Claim 206, wherein the detector further comprises a charge injection device.

209. The detector of Claim 206, wherein the detector further comprises a plurality of sensor elements wherein the sensor elements are adjacent each other to form the detector.

210. The detector of Claim 206, wherein the detector further comprises a computer that processes the digital data corresponding to the scattered illumination from the substrate.

211. The detector of Claim 210, wherein the computer further comprises a dithering module.

212. A substrate handler, comprising:

a substrate holder that is capable of holding a substrate so that a first side and a second side of a substrate are capable of being illuminated simultaneously; and

wherein the substrate is held by its edges.

213. The substrate handler of Claim 212 further comprising a moving mechanism wherein the moving mechanism further comprises one or more wheels that rotate the substrate holder to position the substrate, the substrate holder further comprising one or more edge gripper mechanisms that support the substrate at its edges.

214. The substrate handler of Claim 212 further comprising a moving mechanism wherein the moving mechanism further comprises one or more ring bearings that permit rotation of the holder to position the substrate, the substrate holder further comprising one or more edge gripper mechanisms that support the substrate at its edges.

215. The substrate handler of Claim 213, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

216. The substrate handler of Claim 215, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

217. The substrate handler of Claim 216, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

218. The substrate handler of Claim 213, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

219. The substrate handler of Claim 218, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

220. The substrate handler of Claim 219, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

221. The substrate handler of Claim 212, wherein the substrate holder further comprises an edge gripper mechanism and a lifting mechanism wherein the lifting mechanism moves the substrate into a position and retracts away from the substrate.

222. The substrate handler of Claim 221, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

223. The substrate handler of Claim 222, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

224. The substrate handler of Claim 223, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

225. The substrate handler of Claim 221, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

226. The substrate handler of Claim 225, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

227. The substrate handler of Claim 226, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

228. An optical inspection system, comprising:

an illumination source that generates electromagnetic radiation that illuminates a first side of a substrate inserted into an optical inspection system; and

a detector that detects a light scattering feature on the first side of the substrate from the illumination scattered from the light scattering feature on the first side of the substrate wherein the light scattering feature from below 0.1 microns to 100 microns is detected.

229. The system of Claim 228, wherein the light scattering features further comprise one of a defect in the substrate, a scratch on a surface of the substrate, a pit on a surface of the substrate, a particle on a surface of the substrate, device patterns and pattern anomalies on a surface of the substrate, etched regions on a surface of the substrate, polish roughness on a surface of the substrate, texture on a surface of the substrate, embedded particles in films on a surface of the substrate and any aspect of a surface of the substrate that scatters light.

230. The system of Claim 228, wherein the illumination source, substrate handler and the detector are incorporated into a stand-alone optical inspection system.

231. The system of Claim 228, wherein the illumination source, substrate handler and the detector are incorporated into a benchtop optical inspection system.

232. The system of Claim 228, wherein the optical inspection system is incorporated into a process tool system.

233. The system of Claim 228, wherein the optical inspection system is incorporated into an equipment front end module system.

234. The system of Claim 228, wherein the illumination source further comprises a polarizer to generate uniformly polarized electromagnetic radiation that is directed towards the substrate.

235. The system of Claim 228, wherein the illumination source further comprises a shadow casting assembly that limits the electromagnetic radiation to the edges of the substrate.

236. The system of Claim 228, wherein the illumination source further comprises an image relay assembly that limits the electromagnetic radiation to the edges of the substrate.

237. The system of Claim 236, wherein the image relay assembly further comprises an aperture that limits the electromagnetic radiation generated by the illumination source to the edges of the substrate.

238. The system of Claim 228, wherein the detector further comprises a movable detector unit that is movable between two or more positions so that the angle of the movable detector unit with respect to the substrate and the angle that the scattered illumination enters the movable detector unit is adjustable.

239. The system of Claim 238, wherein the illumination source further comprises a movable illumination source unit that is movable between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

240. The system of Claim 228, wherein the illumination source further comprises a movable illumination source unit that is movable between two or more positions so that the angle of the illumination illuminating the substrate is adjustable.

241. The system of Claim 228, wherein the illumination source generates bright field illumination and dark field illumination.

242. The system of Claim 228 further comprising a substrate handler that holds a substrate inserted into the optical inspection system.

243. The system of Claim 228, wherein the substrate further comprises a semiconductor wafer.

244. The system of Claim 243, wherein the wafer is unpatterned.

245. The system of Claim 243, wherein the wafer is patterned.

246. The system of Claim 228, wherein the substrate further comprises a disk drive substrate.

247. The system of Claim 228, wherein the illumination source further comprises a ring illumination source adjacent the periphery of the substrate that directs light towards the edges of the substrate so that a light scattering feature on one of an edge and a bevel of the substrate is detected.

248. The system of Claim 228, wherein the illumination source further comprises a plurality of illumination source units that each illuminate a different parallel strip of the substrate to provide illumination uniformity.

249. The system of Claim 228, wherein the illumination source further comprises a plurality of illumination source units located around the periphery of the substrate.

250. The system of Claim 228, wherein the illumination source further comprises a set of light path optics that directs the illumination energy from the illumination source to the substrate.

251. The system of Claim 228, wherein the illumination source further comprises an electromagnetic radiation source that generates at least deep ultraviolet electromagnetic energy.

252. The system of Claim 228, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting light scattering features close to large scattering features, differential measurements where small scattering features have been added to high scatter regions and process signatures.

253. The system of Claim 228, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting brightfield substrate features.

254. The system of Claim 228, wherein the detector further comprises a high dynamic range, high precision detector array that is capable of detecting bar code and alphanumeric substrate identification substrate features.

255. The system of Claim 228, wherein the detector further comprises an anti-blooming detector.

256. The system of Claim 255, wherein the detector provides random access read-out of each pixel associated with the detector and the read-out of each pixel of the detector is non-destructive.

257. The system of Claim 228, wherein the detector further comprises a detector head that comprises a detector chip and a microprocessor that controls the operation of the detector chip.

258. The system of Claim 228, wherein the detector further comprises a back thinned detector chip so that electromagnetic radiation is detected through a backside of the detector chip.

259. The system of Claim 228, wherein the detector further comprises one or more detector chips each having an array of detector pixels wherein each detector chip is butted against another detector chip to form an larger array of detector pixels.

260. The system of Claim 228, wherein an angle of incidence of scattering feature illumination light on the detector is between 50 degrees and 75 degrees.

261. The system of Claim 228, wherein the scattering feature light impinging on the detector is collimated to less than or equal to +/- 2 degrees from the nominal angle of incidence.

262. The system of Claim 228, wherein the scattering feature light impinging on the substrate is spatially uniform in intensity across the substrate with uniformity equal to or greater than 50%.

263. The system of Claim 228, wherein the scattering feature light impinging on the substrate is spectrally uniform across the beam collimated equal to or greater than 95%

264. The system of Claim 228, wherein the detector further comprises collection optics that images the scattered illumination from the light scattering features of the substrate onto the detector.

265. The system of Claim 228, wherein the detector further comprises collection optics having a device that scans through a plurality of wavelengths during the inspection of the substrate.

266. The system of Claim 228, wherein the illumination source further comprises a device that scans through a plurality of wavelengths during the inspection of the substrate.

267. The system of Claim 266, wherein the wavelength scanning device further comprises a wavelength selectable filter that adjust the wavelength of the electromagnetic radiation during the inspection of a substrate to classify the light scattering feature on the surface of the substrate.

268. The system of Claim 228, wherein the illumination source delivers at least 0.25 watts per square inch to the substrate.

269. The system of Claim 268, wherein the illumination source delivers more than 0.25 watts per square inch to the substrate.

270. The system of Claim 228, wherein the illumination source further comprises an arc lamp source that productes deep ultraviolet electromagnetic radiation.

271. The system of Claim 228, wherein the illumination source further comprises one of a laser source, a light emitting diode source, a combination of sources such as deuterium and tungsten, and arc lamps with mercury or other gas mixtures.

272. The system of Claim 228, wherein the illumination source further comprises a focused arc source which reduces the optics needed to focus the electromagnetic radiation onto the substrate.

273. The system of Claim 228, wherein the illumination source further comprises a broadband electromagnetic radiation source that generates electromagnetic radiation at a plurality of wavelengths.

274. The system of Claim 273, wherein the plurality of wavelengths further comprises 200 nm to 1100 nm.

275. The system of Claim 228, wherein the illumination source is modulated which improves the signal to noise ratio of the system.

276. The system of Claim 228, wherein the detector further comprises a collection light path from the substrate to the detector, the light path further comprising refractive elements wherein the scattered illumination from the light scattering features on the substrate is imaged onto the detector.

277. The system of Claim 228, wherein the detector further comprises a collection light path from the substrate to the detector, the light path further comprising a refractive lens and a reflective Schwarzchild lens.

278. The system of Claim 228, wherein the detector further comprises a plurality of pixels and a microlens associated with each pixel of the detector wherein the each microlens focuses the scattering feature illumination onto the pixel associated with the microlens.

279. The system of Claim 228, wherein the detector further comprises a digital sensor device having a plurality of pixels, each pixel of the digital sensor having an integrated pixel pre-amplifier.

280. The system of Claim 279, wherein the digital sensor further comprises a charge injection device.

281. The system of Claim 228, wherein the detector further comprises a CMOS sensor.

282. The system of Claim 228, wherein the detector further comprises a CCD sensor.

283. The system of Claim 228, wherein the detector further comprises a photodiode array sensor.

284. The system of Claim 228, wherein the detector further comprises a plurality of sensor elements wherein the sensor elements are adjacent each other to form the detector.

285. The system of Claim 228, wherein the detector further comprises a computer that processes digital data corresponding to the scattered illumination from the light scattering feature on the substrate.

286. The system of Claim 285, wherein the detector further comprises a dithering process.

287. The system of Claim 285, wherein the detector further comprises a random integration process.

288. The system of Claim 242, wherein the substrate handler further comprises a substrate holder further comprising one or more edge gripper mechanisms that support the substrate at its edges so that both sides of the substrate are optically inspected.

289. The system of Claim 288, wherein the substrate handler further comprises one or more wheels that rotate the substrate holder to position the substrate.

290. The system of Claim 288, wherein the substrate handler further comprises one or more ring bearings that permit rotation of the substrate holder to position the substrate.

291. The system of Claim 288, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

292. The system of Claim 291, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

293. The system of Claim 292, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

294. The system of Claim 288, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

295. The system of Claim 294, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

296. The system of Claim 295, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

297. The system of Claim 242, wherein the substrate handler further comprises an edge gripper mechanism and a lifting mechanism wherein the lifting mechanism moves the substrate into a position and retracts away from the substrate.

298. The system of Claim 297, wherein the edge gripper mechanism further comprise an edge gripper structure and a support structure wherein the edge gripper structure grips the substrate and the support structure supports the substrate when the edge gripper structure is retracted.

299. The system of Claim 298, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

300. The system of Claim 299, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

301. The system of Claim 297, wherein the edge gripper mechanism further comprises a support structure and an edge gripper structure integrated into the support structure to support the substrate and grip the substrate wherein the edge gripper structure extends out from the support structure when the substrate is being gripped.

302. The system of Claim 301, wherein the support structure has a beveled portion and a flat pad end portion wherein the substrate rests on the beveled portion.

303. The system of Claim 302, wherein the edge gripper structure further comprises a tapered region and a beveled indentation end of the tapered region, the beveled indentation end gripping an edge of the substrate without extending beyond the edge of the substrate.

304. The system of Claim 228 further comprising a computer system that controls the operation of the illumination source and the detector, wherein the computer system further comprises a differential measurement process wherein an initial light scattering feature measurement is subtracted from a subsequent light scattering feature measurement.

305. The system of Claim 228 further comprising a sealed enclosure to reduce contaminants within the optical inspection system.

306. The system of Claim 205, wherein the sealed enclosure is one or more of vacuum tight, gas tight and light tight.

307. The system of Claim 228, wherein the illumination source further comprises an edge illumination source that directs electromagnetic radiation towards a bevel of the substrate so that the

detector receives the illumination scattered from a light scattering feature on the bevel of the substrate and detects light scattering features on the bevel of the substrate.

308. The system of Claim 265, wherein the wavelength scanning device further comprises a wavelength band pass filter that selectively permits scattering feature illumination for a particular wavelength to impinge of the detector.

309. The system of Claim 228, wherein the illumination source further comprises a shutter that blocks the electromagnetic radiation before the electromagnetic radiation illuminates the substrate.

310. The system of Claim 228, wherein the illumination source further comprises an intensity sensor that measures the intensity of the electromagnetic radiation emitted by the illumination source.

311. The system of Claim 228, wherein the detector further comprises a polarizer that filters the scattering feature light according to the polarization of the scattering feature scattered light.

312. The system of Claim 311, wherein the illumination source further comprises a polarizer that is aligned so that the scattering feature scattered light is cross polarized with respect to the polarizer at the detector.

313. The system of Clam 228, wherein the illumination source further comprises a homogenizer.

314. The system of Claim 228, wherein the illumination source further comprises a device that filters infrared electromagnetic radiation out of the illumination directed towards the substrate.

315. The system of Claim 228, wherein the illumination source generates infrared electromagnetic radiation that is directed towards the substrate to measure characteristics of the substrate including one of film thickness, substrate structure, thickness and uniformity.

316. The system of Claim 228 further comprising a computer system that controls the illumination source and the detector, the computer system further comprising a module for determining a process problem signature based on the light scattering features detected on the substrate.

317. The system of Claim 242, wherein the substrate handler orients a notch of the substrate at approximately 45 degrees with respect to the electromagnetic radiation from the illumination source.

318. The system of Claim 228, wherein the illumination source further comprises a dual ring illumination source that illuminates an edge and a bevel of the substrate to detect light scattering features on the edge and bevel of the substrate.

319. The system of Claim 228 further comprising a flip mirror that directs the electromagnetic radiation from the illumination source to both surfaces of the substrate at different time periods.

320. The system of Claim 319 further comprising a second flip mirror that directs the illumination from the light scattering features on the first side to the detector at a predetermined time and that directs the illumination from the light scattering features on the second side to the detector at a second predetermined time.

321. The system of Claim 228 further comprising a beam dump that absorbs the illumination that is not scattered by the light scattering features on the first and second sides of the substrate, the beam dump further comprising one or more light absorbing plates wherein the light is reflected between the one or more light absorbing plates.

322. The system of Claim 321, wherein the one or more light absorbing plates further comprises a first light absorbing plate positioned so that the light strikes the first light absorbing plate at an angle of 30 to 60 degrees.

323. The system of Claim 246, wherein the disk drive substrate further comprises a disk region that surrounds a central hole and wherein the illumination source generates a washer shaped illumination pattern that illuminates the disk region but not the central hole.

324. The system of Claim 323, wherein the illumination source further comprises a first illumination source that generates an illumination pattern that illuminates a first portion of the disk region wherein the disk region is entirely illuminated when the disk drive substrate is rotated.

325. The system of Claim 323, wherein the illumination source further comprises a second illumination source that generates an illumination pattern that illuminates a second portion of the disk region different from the first portion, wherein the first and second illumination sources are rotated 90 degrees with respect to each other and the first and second portions of the disk region comprise the entire disk region.

326. The system of Claim 323, wherein the illumination source generates electromagnetic radiation that is perpendicular to a texture of the disk drive substrate to measure the texture of the disk drive substrate.

327. An illumination Source, comprising:

an electromagnetic energy radiation source that produces broadband electromagnetic radiation including deep ultraviolet radiation;

a filter that removes the infrared electromagnetic radiation from the generated electromagnetic radiation;

a parabolic light collection reflector that collects the electromagnetic radiation from the electromagnetic energy radiation source and focuses the electromagnetic energy in a particular direction;

a homogenizer; and

an assembly that limits the electromagnetic radiation to a predetermined area wherein the electromagnetic radiation is collimated to less than or equal to +/- 2 degrees from the nominal angle of incidence, is spatially uniform in intensity across the substrate with uniformity equal to or greater than 50% and delivers at least 0.25 watts per square inch.

328. The illumination source of Claim 327, wherein the filter further comprises a dichroic mirror.

329. The illumination source of Claim 327, wherein the generated electromagnetic radiation is spectrally uniform across the beam collimated equal to or greater than 95%.

330. The illumination source of Claim 327 further comprising a device that scans through a plurality of wavelengths.

331. The illumination source of Claim 330, wherein the wavelength scanning device further comprises a wavelength selectable filter that adjust the wavelength of the electromagnetic radiation.

332. The illumination source of Claim 327, wherein the illumination source delivers more than 0.25 watts per square inch to the substrate.

333. The illumination source of Claim 327 further comprising a polarizer to generate uniformly polarized electromagnetic radiation.

334. The illumination source of Claim 327, wherein the assembly further comprises a shadow casting assembly that limits the electromagnetic radiation to the edges of the substrate.

335. The illumination source of Claim 327, wherein the assembly further comprises an image relay assembly that limits the electromagnetic radiation to the edges of the substrate.

336. The illumination source of Claim 335, wherein the image relay assembly further comprises an aperture that limits the electromagnetic radiation generated by the illumination source to the edges of the substrate.

337. The illumination source of Claim 327, wherein the illumination source generates bright field illumination and dark field illumination.

338. The illumination source of Claim 327 further comprising an arc lamp source that produces deep ultraviolet electromagnetic radiation.

339. The illumination source of Claim 327 further comprising one of a laser source, a light emitting diode source, a combination of sources such as deuterium and tungsten, and arc lamps with mercury or other gas mixtures.

340. The illumination source of Claim 327 further comprising a focused arc source which reduces the optics needed to focus the electromagnetic radiation onto a substrate.

342. The illumination source of Claim 327 further comprising a broadband electromagnetic radiation source that generates electromagnetic radiation at a plurality of wavelengths.

343. The illumination source of Claim 342, wherein the plurality of wavelengths further comprises 200 nm to 1100 nm.

344. The illumination source of Claim 327, wherein the illumination source is modulated which improves the signal to noise ratio of the system.

345. The illumination source of Claim 327 further comprising a shutter that blocks the electromagnetic radiation before the electromagnetic radiation illuminates a substrate.

346. The illumination source of Claim 327 further comprising an intensity sensor that measures the intensity of the electromagnetic radiation emitted by the illumination source.